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E T U O I K E U S T O D I S T U S
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Title of invention

"Mobile Application Part Transport Mechanism"
(MAP-siirtomekanismi)

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Mobile Application Part Transport Mechanism

Field of the Invention

The present invention relates to a Mobile Application Part transport mechanism for use in a Public Land Mobile Network.

Background to the Invention

In existing Public Land Mobile Networks (PLMN), signalling information, e.g. relating to call set-up procedures, management, and teardown, is generally carried between signalling points by a Signalling System No.7 (SS7) based transport mechanism. SS7 is a widely used transport protocol involving multiple protocol layers.

Information is exchanged between Mobile Switching Centres (MSCs), Home Location Registers (HLRs), and Visitor Location Registers (VLRs) using messages defined by the standardised Mobile Application Part (MAP) protocol, messages which are carried by the SS7 transport mechanism. More particularly, the SS7 layers involved in the transport of the MAP messages are:

a Message Transport Part (MTP) which handles *inter alia* message separation, error detection and correction, as well as an interface to the physical data link;

a Signalling Connection and Control Part (SCCP) which is responsible for controlling signalling connections in the SS7 network as well as for routing between signalling points; and

a Transaction Capabilities Application Part (TCAP) which facilitates the use of advanced Intelligent Network (IN) services by providing for the exchange of

information between signalling points using a connectionless service of the SCCP.

The complexity of the conventional transport mechanism will be readily apparent, but such complexity is required in order to ensure the correct routing and error free transmission of signalling data between the numerous signalling points of a PLMN.

Summary of the Present Invention

It has been recognised by the inventors of the present invention that the complex SS7 transport mechanism is not necessary for transporting MAP messages between signalling points of a PLMN which are co-located, i.e. which are located in close proximity to one another. Thus, it is possible to employ a "lightweight" transport mechanism which reduces or eliminates the coding and decoding requirements inherent in the SS7 transport mechanism.

According to a first aspect of the present invention there is provided a method of transmitting signalling information between two signalling points of a Public Land Mobile Network, which signalling points are co-located, the method comprising;

formulating said signalling information into messages according to the Mobile Application Part (MAP) protocol; and

transmitting the messages between the two signalling points using a packet switched data network.

As the signalling points to which the method of the present invention is applied are co-located, it is possible to couple the two signalling points using a direct connection.

Embodiments of the present invention remove the requirement for processing signalling information using TCAP and SCCP when the information is to be transmitted between co-located signalling points.

Preferably, the above method is used in a network after a signalling point wishing to send a MAP message has determined whether or not the message is destined for a co-located signalling point. In the event that the destination signalling point is not co-located, then a network other than said packet switched data network may be used to transport the message. One such alternative network is an SS7 network.

Preferably, the co-located signalling points of a PLMN coupled by the said packet switched data network include two or more of a Mobile Switching Centre (MSC), a Gateway Mobile Switching Centre (GMSC), a Home Location Register (HLR), and a Visitor Location Register (VLR). The signalling points may also include one or more Intelligent Network (IN) nodes.

Preferably, the packet switched data network is an IP network, where the MAP sits on top of the IP layers (including an IP protocol layer, and a TCP and/or UDP layer) at each of the co-located signalling points. Where the co-located signalling points have access to an SS7 network, the MAP at the signalling points may also sit on top of the SS7 protocol layers. More preferably, an adaptation layer is provided between the MAP and the IP and SS7 layers, the adaptation layer responding to a MAP dialogue initiation by determining whether or not the destination address (e.g. Global Title) for the dialogue corresponds to or is associated with a co-located signalling point. If the destination address (e.g. Global Title) for the dialogue does correspond to

a co-located signalling point, then the adaptation layer determines the IP address corresponding to the destination address.

According to a second aspect of the present invention there is provided apparatus for transmitting signalling information between two signalling points of a Public Land Mobile Network, which signalling points are co-located, the apparatus comprising;

first signal processing means for formulating said signalling information into messages according to the Mobile Application Part (MAP) protocol;

second signal processing means for formulating MAP messages according to a packet switched data transport mechanism; and

transmission means for transmitting the formulated packet switched messages between the two signalling points over a packet switched network.

According to a third aspect of the present invention there is provided a signalling point within a Public Land Mobile Network (PLMN), the signalling point comprising:

first signal processing means for formulating said signalling information into messages according to the Mobile Application Part (MAP) protocol;

second signal processing means for formulating MAP messages according to a packet switched data transport mechanism; and

transmission means for transmitting the formulated packet switched messages to a second co-located signalling point over a packet switched network.

The signalling point may also act as a signalling transfer point for messages received from non-co-located signalling points, whereby the signalling transfer point

relays MAP messages to a co-located signalling point over the packet switched network.

Preferably, the signalling point comprises means for determining whether or not a destination signalling point for a MAP message is co-located and, if so, for passing the MAP messages to said second signal processing means and, if not, for passing the MAP messages to an SS7 transport mechanism to provide for transmission of the messages over an SS7 network.

Brief Description of the Drawings

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 illustrates schematically a part of a Public Land Mobile Network;

Figure 2 illustrates the transport mechanism protocol stack implemented at certain signalling points of the PLMN of Figure 1; and

Figure 3 is a flow diagram illustrating a method of transmitting Mobile Application Part messages between signalling points of the PLMN of Figure 1.

Detailed Description of Certain Embodiments

In Figure 1 there is illustrated schematically a Public Land Mobile Network (PLMN) comprising two Gateway Mobile Switching Centres (GMSCs) 1,2 which provide the interface between the PLMN and a Public Switched Telephone Network (PSTN) 3. The GMSCs 1,2 "represent" the PLMN from the view point of the PSTN 3 and signalling communications therebetween are carried using the ISDN User Part (ISUP) protocol. The GMSCs may also

provide the interfaces between the PLMN and other networks although this is not shown in Figure 1.

Within the PLMN, it is necessary to communicate signalling information between signalling points of the network for the purpose of call set-up, management, and teardown. Figure 1 illustrates a number of signalling points within the PLMN including: the GMSCs 1,2; Mobile Switching centres (MSCs) 4,5 which are responsible for routing calls within the PLMN; Visitor Location Registers (VLRs) 6,7 which maintain a record of the subscribers registered with associated MSCs at any given time; and Home Location Registers (HLRs) 8,9 which maintain a permanent record of the PLMN subscribers together with a dynamic record of the location of those subscribers at any given time. These signalling points are in close proximity to one another, i.e. they are "co-located". In some circumstances the co-located signalling points may be located in the same room.

Signalling information is conveyed between the various signalling points of the PLMN using the Mobile Application Part (MAP) interface protocol. Conventionally, MAP messages are transported using the SS7 transport mechanism. This mechanism will not be described in detail here (reference should be made for example to "Understanding Telecommunications", Vols 1 & 2, Studentlittaratur, Lund, Sweden, ISBN 91-44-00214-9), although Figure 1 does illustrate the provision of an SS7 network in which SS7 signalling links (illustrated by broken lines) may be routed via a Signalling Transfer Point (STP) 10. The SS7 transport mechanism is also used to convey ISUP signalling messages between the GMSCs 1,2 and the PSTN 3.

In Figure 1, the solid lines indicate Ethernet connections between signalling points. These Ethernet connections are used to carry IP datagrams encapsulating MAP messages, providing an alternative to the SS7 transport mechanism described in the preceding paragraph. It is noted that only direct ethernet connections (point-to-point) are provided between signalling points, i.e. there is no requirement for routers in the IP network.

Figure 2 shows the protocol which is implemented at each of the PLMN signalling points. The MAP 11 sits on top of a so-called "adaptation layer" 12 which in turn sits on top of two distinct protocol stacks. A first of these stacks 13 provides the conventional SS7 transport mechanism, whilst the second 14 provides for the IP transport mechanism. As far as the MAP 11 is concerned, the adaptation layer 12 behaves identically to the TCAP so that no modifications to the MAP 11 are required.

Initialisation of a MAP dialogue commences with a dialogue request message being passed from the MAP 11 to the adaptation layer 12. The adaptation layer uses a user reference contained in the dialogue request message to determine the associated Sub-System Number (SSN). If the SSN does not indicate that the user is a HLR, VLR, or MSC, the dialogue is designated for SS7 and the normal SS7 procedures utilised (i.e. protocol stack 13).

If, on the other hand, the SSN does indicate that the user is a HLR, VLR, or MSC, the called address, i.e. Global Title (GT), is checked by the adaptation layer 12. Each of the MSC/VLRs, GMSCs, and HLRs which are co-located with the originating signalling point is associated with a Global Title series. These series are pre-recorded in an address table, accessible to the

adaptation layer 12. The address table contains a mapping between Global Title series and IP addresses. If the check determines that the called Global Title is not a member of one of the recorded Global Title series, the dialogue is again transported over SS7. However, if the check confirms that the called Global Title is a member of a recorded Global Title series, then, providing that the TCP/IP link towards that address is active, a request granted message returned to the MAP 11 by the adaptation layer. In the event that the identified link is not active, then the dialogue is once again transported over SS7. Subsequent messages relating to the same dialogue are transported over IP or SS7 depending upon the initial checks performed by the adaptation layer.

To limit the processor load required for checking an address called by a MAP dialogue request message, the number of addresses contained in the address table is restricted to a relatively small number, i.e. the number of co-located signalling points which can make use of the lightweight IP transport mechanism is restricted. A suitable number of signalling points may be six or less.

Figure 3 is a flow diagram illustrating the processing steps carried out at a signalling point following initiation of a MAP dialogue. Typically, these steps are carried out by a suitably programmed computer, or by one or more Digital Signal Processors (DSPs), although other suitable implementations will be readily apparent.

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiment without departing from the scope of the present invention. For example, rather than using the TCP routing protocol above the IP protocol, a simpler routing protocol may be used, e.g. Point to

Point Protocol (PPP). In a further modification, the invention may be employed to relay MAP messages received at a signalling transfer point from an originating signalling point, not co-located with the receiving signalling point, to a destination signalling point which is co-located with the signalling transfer point. In this case, the signalling transfer point will check whether or not the destination address of the received MAP messages is contained within the address table already described and, if so, determine the associated IP address.

Claims

1. A method of transmitting signalling information between two signalling points of a Public Land Mobile Network, which signalling points are co-located, the method comprising;

formulating said signalling information into messages according to the Mobile Application Part (MAP) protocol; and

transmitting the messages between the two signalling points using a packet switched data network.

2. A method according to claim 1, comprising a step of determining, at a signalling point wishing to send a MAP message, whether or not the message is destined for a co-located signalling point and, in the event that the destination signalling point is not co-located, then transporting the message over a network other than said packet switched data network.

3. A method according to claim 1 or 2, wherein the co-located signalling points of the PLMN coupled by the said packet switched data network include two or more of a Mobile Switching Centre (MSC), a Gateway Mobile Switching Centre (GMSC), a Home Location Register (HLR), and a Visitor Location Register (VLR).

4. A method according to any one of the preceding claims, wherein the packet switched data network is an IP network and the MAP sits on top of the IP layers at each of the co-located signalling points.

5. A method according to claim 4, wherein the co-located signalling points have access to an SS7 network and the MAP at the signalling points sits on top of the SS7 protocol layers.

6. A method according to claim 5, wherein an adaptation layer is provided between the MAP and the IP and SS7 layers, the adaptation layer responding to a MAP dialogue initiation by determining whether or not the destination address for the dialogue corresponds to a co-located signalling point and, if the destination address for the dialogue does correspond to a co-located signalling point, then the adaptation layer determines the IP address corresponding to the destination address.

7. Apparatus for transmitting signalling information between two signalling points of a Public Land Mobile Network, which signalling points are co-located, the apparatus comprising;

first signal processing means for formulating said signalling information into messages according to the Mobile Application Part (MAP) protocol;

second signal processing means for formulating MAP messages according to a packet switched data transport mechanism; and

transmission means for transmitting the formulated packet switched messages between the two signalling points over a packet switched network.

8. A signalling point within a Public Land Mobile Network (PLMN), the signalling point comprising:

first signal processing means for formulating said signalling information into messages according to the Mobile Application Part (MAP) protocol;

second signal processing means for formulating MAP messages according to a packet switched data transport mechanism; and

transmission means for transmitting the formulated packet switched messages to a second co-located signalling point over a packet switched network.

9. A signalling point according to claim 8, wherein the signalling point acts as a signalling transfer point for messages received from non-co-located signalling points, whereby the signalling transfer point relays MAP messages to a co-located signalling point over the packet switched network.

10. A signalling point according to claim 8 or 9, wherein the signalling point comprises means for determining whether or not a destination signalling point for a MAP message is co-located and, if so, for passing the MAP messages to said second signal processing means and, if not, for passing the MAP messages to an SS7 transport mechanism to provide for transmission of the messages over an SS7 network.

Abstract (57)
A method of transmitting signalling information between two co-located signalling points of a Public Land Mobile Network. Signalling messages are formulated according to the Mobile Application Part (MAP) protocol and are passed to an adaptation layer which determines whether or not an IP address is available for the destination signalling point. If an IP address is available, the MAP messages are transmitted between the two signalling points using a packet switched data network, otherwise an SS7 network is used to transport the messages.
Fig. 1

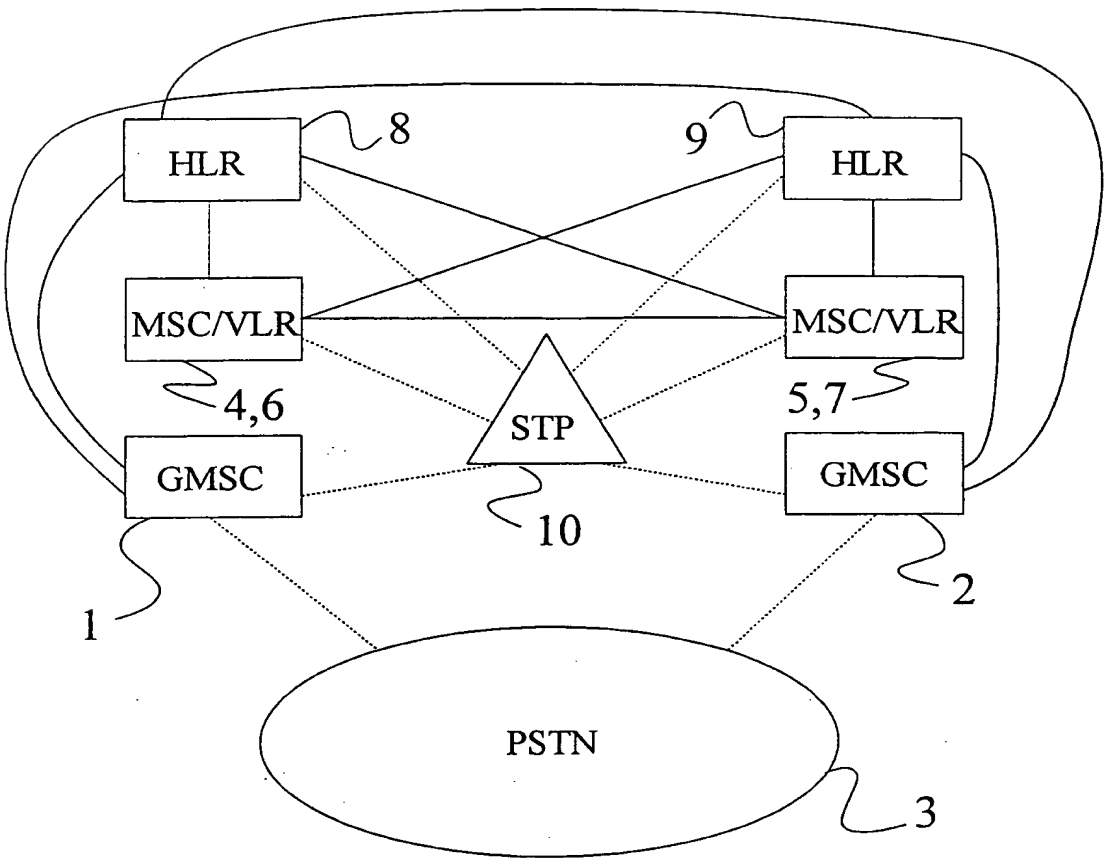

Figure 1

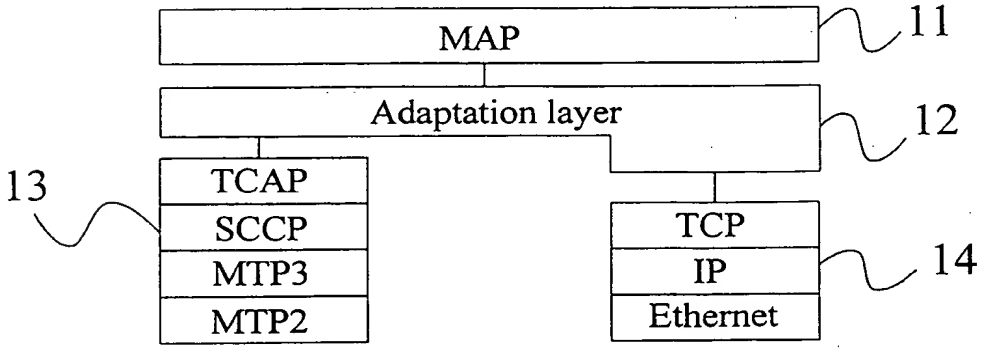

Figure 2

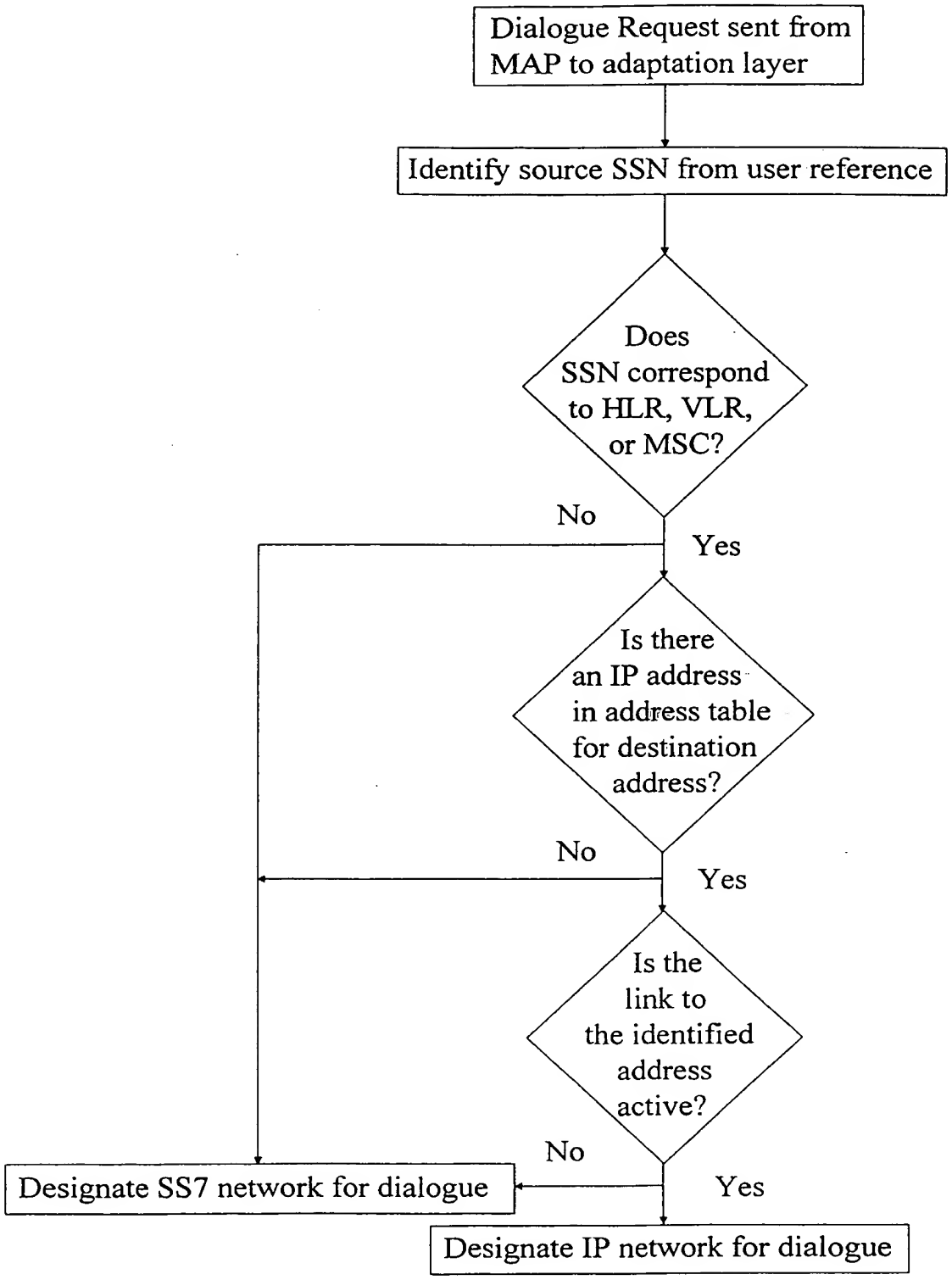
Dialogue Request sent from MAP to adaptation layer
Identify source SSN from user reference
Does SSN correspond to HLR, VLR, or MSC?
No
Yes
Is there an IP address in address table for destination address?
No
Yes
Is the link to the identified address active?
No
Yes
Designate SS7 network for dialogue
Designate IP network for dialogue

Figure 3